

6th SEMESTER
DISCIPLINE SPECIFIC ELECTIVES (DSEs)

OPTION-I

BOT616DA: BOTANY: ECONOMIC BOTANY AND BIOTECHNOLOGY

Theory

Unit – 1: Origin of cultivated plants

- Concept of centres of origin, their importance with reference to Vavilov's work; crop domestication and loss of genetic diversity; importance of germplasm diversity.
- **Cereals:** Origin, morphology and uses of Wheat, Rice and Maize. Brief account of millets and pseudo-cereals.

Unit – 2: Legumes, Spices and Sugars

- **Legumes:** Introduction, importance to man and ecosystem with special reference to Gram, Soyabean and Kidney Bean.
- **Spices and condiments:** Introduction; systematic position, morphological features and uses of *Crocus sativus*; *Curcuma domestica*; *Syzygium aromaticum*; *Piper nigrum*; *Elettaria cardamomum* & *Bunium persicum*.
- General account of Starch and Sugars with special reference to Potato & Sugar cane.

Unit – 3: Beverages, Oils, fibres & Medicinal plants

□ **Beverages:** Introduction; processing and uses of Tea.

- General account of Oils and Fats; extraction methods of essential oils; Systematic position and uses of Brassica, Coconut, Lavender.
- **Fibres:** Classification of fibres (Based on origin); morphology, extraction & uses of Cotton.
- **Medicinal & Narcotic Plants:** Systematic position, chemical constituents and uses of *Saussurea costus*, *Arnebia benthamii* & *Papaver somniferum*.

Unit – 4: Biotechnology & Biotechnological techniques:

- Introduction & importance of Biotechnology; brief account of plant tissue culture, concept of somaclonal variation; germplasm storage (cryopreservation). Concept of restriction enzymes.
- **Cloning Vectors for recombinant DNA:** Plasmids (Ti & Ri plasmids of *Agrobacterium*), Transposons (Ac & Ds of Maize).
- **Biotechnological techniques:** Gene transfer techniques in plants, transgenic plants with special reference to Bt- Cotton & Golden rice; Blotting techniques (Northern, Southern and Western), DNA finger printing; Molecular DNA Markers (RAPD, RFLP & SNPs).
- Principle and applications of Polymerase Chain Reaction (PCR); Hybridoma & monoclonal antibodies;

Practicals

1. Study of economically important plants:
Maize, Rice & Potato – (Habit sketch, starch grains and micro-chemical tests)
2. Study the distribution of oil bodies in some oil yielding seeds – Almond, Walnut, Ground nut, Sarson.
3. Study the surface fibres (Cotton) and Bast fibres (Hemp).
4. Study the different types of spices & condiments – Saffron, Piper, Curcuma, Clove, Cardamom, Black Caraway.
5. Preparation of basic standard culture media from dry powdered media.
6. Study through photographs the 4-step and 3-step micro-propagation of plant material.
7. Study through photographs the process of DNA finger printing.
8. Study through photographs the procedures of AFLP, RFLP and SNPs.

Suggested readings:

1. Bhojwani, S. S. & Razdan, M. K. (1996). Plant tissue culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.
2. Chrispeels, M. J. & Sadava (2003). Plants, Genes and Agriculture. Jones and Bartlett Publishers.
3. Glick, B. R., Pasternak, J. J. (2003). Molecular Biotechnology- Principles & applications of recombinant DNA. ASM Press, Washington.
4. Kochhar, S. L. (2011). Economic Botany in the Tropics, MacMillan Publishers India Ltd., New Delhi. 4th edition.
5. Panday, B. P. (1999) Economic Botany. S. Chand and Company Ltd.
6. Sambamurthy A.V.S.S. & Sambamurthy(2000). Economic Botany of Crop Plants. Asiatech Publishers Inc.
7. Simmonds N. W. (1984). Evolution of crop plants (edited by Norman Willison Simmonds). Longman Inc., New York.
8. Wickens, G. E. (2001). Economic Botany- Principles & Practices. Kulwer Academic Publishers. The Netherlands.

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OPTION-II

BOT616DB: BOTANY: GENETICS AND PLANT BREEDING

THEORY

Unit 1: Heredity **(16hours)**

Mendelian principles of inheritance; modified Mendelian ratios: 2:1- lethal Genes; 1:2:1- Co-dominance, incomplete dominance; 9:7; 9:4:3; 13:3; 12:3:1 and 15:1.

Multiple allelism and pleiotropy with examples.

Quantitative inheritance: concept, monogenic vs polygenic inheritance.

Unit 2: Genes and Chromosomes **(20 hours)**

Chromosomal theory of inheritance, Chromosomal mechanisms of sex-determination and sexlinked Inheritance.

Linkage: concept; complete & incomplete linkage, Bridges experiment.

Crossing over: concept and significance.

Numerical changes in chromosomes– euploidy, aneuploidy

Structural changes - deletions, duplications, inversions & translocations.

Unit 3: Plant Breeding: **(12hours)**

Concept and conservation of germplasm.

Origin and domestication of crop plants with reference to rice and wheat, plant genetic resources.

Plant introduction, acclimatization.

Selection methods for self-pollinated, cross-pollinated and vegetatively propagated plants.

Unit 4: Methods of crop improvement (12 hours)

Polyploidy and distant hybridization - their role in crop improvement. of inbreeding depression and heterosis; applications.

Inbreeding depression and heterosis - genetic basis

Hybridization techniques and utility in propagated plants; advantages & limitations.

Concept of point mutations, their role in crop improvement.

Practical

1. Mendel's laws through seed ratios. Laboratory exercises in probability and chi-square.
2. Problems based on Mendelian ratios and non-Mendelian ratios through probability reframe and Chi—square test. – 3:1 and 9:3:3:1.
3. Chromosome mapping using point test cross data.
4. Pedigree analysis for dominant and recessive autosomal and sex linked traits.
5. Incomplete dominance and gene interaction through seed ratios (9:7, 9:6:1, 13:3, 15:1, 12:3:1, 9:3:4).
6. Photographs/Permanent Slides showing Translocation Ring, Laggards and Inversion Bridge.
7. Hybridization techniques - Emasculation, Bagging (For demonstration only).

Suggested Readings:

1. Gardner EJ, Simmons MJ, Snustad DP (2008). Principles of Genetics. 8th Ed. WileyIndia.
2. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics, John Wiley & Sons Inc., India. 5th edition.
3. Klug WS, Cummings MR, Spencer, C, Palladino, M (2011). Concepts of Genetics, 10th Ed., Benjamin Cummings
4. Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis. W. H. Freeman and Co., U.S.A. 10th edition.
5. Pierce BA (2011) Genetics: A Conceptual Approach, 4th Ed., Macmillan Higher Education Learning
6. Singh, B.D. (2005). Plant Breeding: Principles and Methods. Kalyani Publishers. 7th edition.
7. Chaudhari, H.K. (1984). Elementary Principles of Plant Breeding. Oxford – IBH. 2nd edition.
8. Acquaah, G. (2007). Principles of Plant Genetics & Breeding. Blackwell Publishing.
9. Karp, G. (2010). Cell Biology, John Wiley & Sons, U.S.A. 6th edition.
10. Hardin, J., Becker, G., Skliensmith, L.J. (2012). Becker's World of the Cell, Pearson Education Inc. U.S.A. 8th edition.

6th SEMESTER
DISCIPLINE SPECIFIC ELECTIVES (DSEs)
OPTION-III

BOT616DC: BOTANY: PLANT PATHOLOGY

Theory

Unit I

Introduction to Plant Pathology: Scope and importance of plant pathology, terms used in plant pathology. **Plant Pathogen** (General characters): Fungi, Bacteria, Nematodes, Virus, MLO'S and RLO'S.

Plant disease: Concept and classification of plant disease, Symptoms and identification of plant disease, Koch's postulates.

Parasitism and disease development: Parasitism and pathogenicity, pathogenesis, Disease cycle, Inoculum, inoculation, penetration, infection, invasion and colonization, Dissemination of pathogen, by soil, water and dispersal of various categories of pathogens.

(20 Lectures) Unit II

Disease development: Factors affecting disease development, role of enzyme and toxin in disease development.

Disease Epidemics: Elements of disease epidemics, role of host and pathogenic factors on disease epidemics.

Plant Disease Diagnostics: Methods of plant disease diagnostics.

(10 Lectures) Unit III Plant

Disease Management

Regularity methods: Quarantine and inspections.

Physical methods: Soil sterilization, Hot water treatment, Hot air treatment, Radiation, Refrigeration.

Cultural methods: Sanitation, Ploughing, Crop rotation, mix cropping, inter cropping and Organic amendments.

Chemical methods: types of chemicals used for plant disease control.

Biological control: Fungal and bacterial antagonists as bio-agents.

(15 Lectures) Unit IV

Specific Plant Diseases

Symptoms, causal organism, disease cycle and control of: Late blight of Potato, Downy mildew of Onion, Powdery mildew of Cucurbits, Paddy blast, Root knot of tomato and brinjal, Alternaria leaf blight of apple, Brown rot of apple and peach, bacterial blight of rice and Potato mosaic virus disease.

(15 Lectures)

Practicals/Project Work (2 Credits)

1. Methods of Sterilization.
2. Preparation of culture media: PDA and Richard's medium.
3. Preparation of different stains used in Plant Pathology.
4. Techniques of inoculation.
5. Culturing of some Fungi such as *Rhizopus*, *Penicillium*, *Alternaria*.
6. Isolation of plant pathogens from infected tissue by tissue segment method.
7. Symptoms and studies of some local diseased plant materials through temporary/permanent mounts: Apple scab, Powdery mildew of Cucurbits, *Alternaria* leaf blight of apple and Downey mildew of Onion.

Note: Practical/Project Work is optional and students can opt either of the two.

Books recommended

- 1) Plant pathology by E. J. Butler and S.G. Jones: Mac Millan & Co Ltd.
- 2) Plant pathology by G.N. Agrios: Elsevier.
- 3) Plant pathology by R.S. Singh. Oxford & IBH Publishing Co. Pvt Ltd New Delhi.
- 4) Plant Diseases by R.S. Singh. Oxford & IBH Publishing Co. Pvt Ltd New Delhi. 5) Plant pathology by B.P. Pandey (S.Chand).

6th SEMESTER
DISCIPLINE SPECIFIC ELECTIVES (DSEs)

OPTION-IV

BOT616DD: BOTANY: APPLIED HORTICULTURE

(Credits: Theory – 04; Practical – 02)

Unit – I

15 lectures

- Bearing habit of fruits trees – Central ladder system, open centre system, advanced systems, alternate bearing and its implications.
- Concept, principles and methods of pruning and thinning in fruit crops –advantages and disadvantages, management of tree canopy and aeration.
- Spacing in orchard management (row to row and plant to plant), advantages and limitations.
- Concept of high-density plantation – applications and limitations.

Unit–II

15 lectures

- Introduction, definition and scope of post-harvest technology in J&K State
- Pre-harvest and post-harvest losses in fruit crops-causes and implications, methods of preventing post-harvest losses.
- Different systems of storage and marketing of horticultural crops.
- Organic fruit production, its Prospects and limitations

Unit – III

15 lectures

- Types of fertilizers and their applications in horticultural crops, concept of bio-fertilizers and their utility.
- Types of organic manures and their applications in horticultural crops, vermi-composting and green manuring.
- Importance of irrigation at critical stages of fruit crops, effect of water stress in horticulture fruit production.
- Irrigation practices of fruit orchards, concept of drip irrigation, sprinkle irrigation – prospects and limitations. Harvesting and management of water for irrigation.

Unit – IV

15 lectures

- Nursery techniques and production of healthy plantation materials in temperate fruit crops (special reference to Apple, Peach, Almond and Apricot)
- Rejuvenation of old and senile orchards, factors influencing fruitfulness.
- Introduction of new exotic varieties and their impact on indigenous varieties and economy.
- Principles and applications of fruit processing; handling, processing and value addition in fruit crops (apple, cherry, peach, plum).

Laboratory Exercise: DSE-09 (Credits=2)

- Study of various planning and layout of an orchard.
- Training and pruning and thinning of orchard trees, canopy management.
- Field visit to local orchards for practical demonstration on various diseases and disease symptoms in horticultural crops.
- Field visit to local fruit Mandies for training on grading and packing of apple and its marketing.
- Seed identification of common vegetables and flowers.
- Seed viability test by common and TZ method.
- Identification and sample collection of common diseases and pests of fruits/vegetables
- Estimation of soil moisture content, soil pH and Soil fertility.
- Preparation of fertilizer mixtures and methods of application.
- Determination of soil fertility and soil moisture content through standard techniques.
- Practical demonstration on drip and sprinkle irrigation.
- Identification of various physiological and pathological disorders in nursery plants.
- Site visit of nearby plant propagation nurseries.
- Field visit to local greenhouse / Net House facility
- Practical demonstration of preparation of bio-fertilizers / vermi-compost.

Suggested Readings

1. Adams, C.R. and M. P. Early. 2004. Principles of horticulture. Butterworth – Heinemann, Oxford University Press.
2. Bansil. P.C. 2008. Horticulture in India. CBS Publishers and Distributors, New Delhi.
3. Kumar, N.1997. Introduction to Horticulture, Rajalakshmi Publication, Nagercoil.
4. Chadha, K.L. 2001, Handbook of Horticulture, ICAR, New Delhi.
5. Chandra, R. and M. Mishra. 2003. Micropropagation of horticultural crops. International Book Distributing Co., Lucknow.
6. Chattopadhyaya, P.K.2001. A text book on Pomology (Fundamentals of fruit growing) Kalyani Publication, New Delhi.
7. Christopher, E.P. 2001. Introductory Horticulture, Biotech Books, New Delhi.
8. Edmond, J.B. T.L.Senn, F.S. Andrews and P.G.Halfacre, 1975. Fundamentals of Horticulture, Tata MC. Graw Hill Publishing Co.New Delhi.
9. George Acquaah, 2002, Horticulture-principles and practices. Prentice-Hall of India pvt. Ltd., New Delhi.
10. VijaikumarUmRao. 2008. Horticulture terms – Definitions and Terminology. IBD publishers, Dehradun.
11. Genin, A. 1994. Application of Botany in Horticulture. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.